

# THE LICHEN GENERA *HEPPIA* AND *PELTULA* IN AUSTRALIA

by

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## ABSTRACT

Filson, Rex B. The lichen genera *Heppia* and *Peltula* in Australia. *Muelleria* 6(6): 495-517 (1988). – The Australian species of *Heppia* and *Peltula* are revised. Descriptions and illustrations are presented together with distribution maps for each species. *Heppia brisbanensis* F. Wilson is placed in synonymy with *Heppia lutosa* (Ach.) Nyl., *Heppia placodizans* Zahlbr. is placed in synonymy with *Peltula decorticans* (Müll. Arg.) R. Filson, *Peltula obscurans* Nyl. is placed in synonymy with *P. euploca* (Ach.) Wetmore and the new combination *Peltula subglebosa* (Müll. Arg.) R. Filson is made for the taxon now known as *P. obscurans*. *Heppia acarosporoides* Müll. Arg., *H. deserticola* Zahlbr. and *H. hassei* Zahlbr. are placed as synonyms of *Peltula subglebosa*. *Peltula imbricata* R. Filson is described as new.

## INTRODUCTION

In this paper one species of *Heppia* and nine species of *Peltula* are discussed. These genera have been poorly collected in Australia and records have often been obtained because they have been gathered with other more discernible soil-inhabiting lichens.

Previously these two genera have been placed in the lichen family Heppiaceae (Wetmore 1970; Poelt 1974; Henssen 1974). Marton and Galun (1981) have shown that differences in apothecial ontogeny suggest that this is not a natural family but they temporarily keep the genera together in a "convenience group". Büdel (1987), in discussing the biology and systematics of this group in South Africa, concludes that the ontogenetical differences are sufficient to divide the group into the Heppiaceae and the Peltulaceae.

These lichens frequent damp habitats on soil and rock in arid areas (Wetmore 1970) and are found in the drier parts of all states of Australia. On soil they are usually found in local run-off areas. On rock they are most often seen close to the soil or growing on pockets of soil contained in depressions or hollows in the rock.

## MORPHOLOGY

The thallus of *Heppia* and *Peltula* is squamulose. Based on morphological and anatomical characters the squamules can be differentiated into three forms; clavate, ligulate and peltate (Büdel 1987). Only the clavate and peltate forms are represented in the Australian collections.

1. The thallus of the clavate type is subfruticose, the individual lobes are club-shaped, hollow and unbranched or only simply branched. These thalli are attached to the substrate by an adhesion disk (Büdel 1987).

2. The thalli of the peltate type have peltate lobes and are attached to the substrate by an umbilicus or by rhizines. With thalli growing on earth the rhizines consist of thin, pale brown, short-celled hyphae which are septate, branched and anastomosing. These rhizines are matted or sometimes become joined together into fasciculate bundles which form a thick central cord penetrating deep into the substrate. Both rhizines and cords are extremely difficult to see as often they intermix with sand and rock fragments and only careful washing will enable the complete structure to be observed. With thalli growing on rock two forms of attachment are evident; sometimes (if the rock surface is loose) the rhizines are similar to those growing on soil or sometimes (if the rock surface is hard) the lower cortex extends down to form an umbilicus. The holdfast on very small squamules can almost cover the lower surface, but as the thallus develops, the ratio of holdfast to lower surface becomes less. In the smaller species, like *Peltula omphalodes*, there are sometimes two or three corticate holdfasts.

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Swinscow and Krog (1979) state that a cortex is present in all species of *Peltula* growing in East Africa. Büdel (1987) says that in some species the upper cortex is replaced by an epinecral layer. In Australia it appears that *Heppia lutosa*, *Peltula australiensis*, *P. bolanderi*, *P. decorticans*, *P. imbricata*, *P. patellata*, *P. subglebosa* and *P. zahlbruckneri* have, at least in part, a distinct cortex one to three cells thick and a separate algal layer whereas *Peltula euploca* and *P. omphaliza* have a zone which I have termed the "upper layer". This layer is composed of paraplectenchymatous cortical cells interspersed with algal colonies. *P. omphaliza* has an almost homomerous thallus, the medulla sometimes being almost indistinguishable from the thick upper layer.

All species within this group contain unicellular blue-green algae. Wetmore (1970) says that the phycobiont in *Heppia* is *Scytonema* whereas in *Peltula* it is *Anacystis*. However Bubrick and Galun (1984) present evidence from cultures which shows that several strains of *Gloeocapsa* are present in *Peltula*. In fact they found two distinct strains of *Gloeocapsa* in *P. polyspora* [*P. patellata*] from different geographical regions. The influence of the algae on the thallus produces the deep olive coloration which renders the thallus almost invisible on some soils and is possibly the reason why this group is so poorly collected.

The medulla in *H. lutosa*, *P. australiensis*, *P. patellata* and *P. decorticans* (Fig. 4h) is paraplectenchymatous (Degelius 1954:43) whereas the medulla in *P. bolanderi*, *P. euploca*, *P. imbricata* (Fig. 6c), *P. omphaliza* and *P. zahlbruckneri* is euthyplectenchymatous. This difference appears to be a reliable diagnostic feature in separating *P. decorticans* from the "*omphaliza* - *zahlbruckneri* complex". The medulla of *Peltula subglebosa* sometimes appears to be totally composed of paraplectenchymatous tissue although there is often a thin section of euthyplectenchymatous hyphae in the centre (Fig. 9h).

Specimens of *Peltula decorticans* were found to be parasitised by an unknown species of *Endococcus* (Hawksworth pers. comm.).

## TAXONOMY

### KEY TO SPECIES OF HEPPIA AND PELTULA IN AUSTRALIA

1. Thallus saxicolous
  2. Thallus sorediose
    3. Thallus squamulose; medulla euthyplectenchymatous
      4. Thalli usually solitary; margins of squamules usually downrolled; soredia blue-grey to brown ..... *P. euploca*
      4. Thalli usually clustered; margins of squamules flexuose and usually upturned; soredia brown to black ..... *P. bolanderi*
    3. Thallus areolate; medulla paraplectenchymatous (margins of thallus placodiform; margins of areolae slightly raised; soredia brown to black) ..... *P. decorticans*
  2. Thallus not sorediose
    5. Medulla totally euthyplectenchymatous
      6. Thallus squamulose; apothecia to 0.75 mm diam ..... *P. omphaliza*
      6. Thallus subfruticose; apothecia to 0.25 mm diam ..... *P. zahlbruckneri*
    5. Medulla paraplectenchymatous, sometimes with a thin central band of euthyplectenchymatous hyphae ..... *P. subglebosa*
1. Thallus terricolous
  7. Ascospores numerous in ascus
    8. Thallus lobes >1 mm diam., discrete
      9. Ascospores globose
        10. Epiphytenium K+ red ..... *P. patellata*
        10. Epiphytenium K- ..... *P. australiensis*
      9. Ascospores ellipsoid ..... *P. subglebosa*
    8. Thallus lobes <1 mm diam., imbricate ..... *P. imbricata*
    7. Ascospores eight in ascus ..... *H. lutosa*

## HEPPIA

***Heppia lutosa*** (Ach.) Nyl., Syn. Lich. 2: 56 (1855). - *Collema lutosum* Ach., Syn. Lich.: 309 (1814). TYPE: Germany, "ad terram limosam". HOLOTYPE: "Germania" (H-ACH 1901, photo only seen).

*Heppia brisbanensis* F. Wilson, Qld. Bot. Bull. 7: 32 (1891). TYPE: "On bare earth amidst grass, Hill End, South Brisbane, Queensland J.F. Shirley". LECTOTYPE (here chosen): "On earth in large patches, Dornoch Terrace nr river" on specimen sheet in Shirley's handwriting and on the outside of the packet in F.R.M. Wilson's handwriting "on earth at Hillend, South Brisbane, Q. by J. Shirley 1890" (NSW 1286!).

*Thallus* squamulose, grey to olive, sometimes forming a rosette-like group; squamules irregularly round to elongate, to 8 mm diam., concave or flat; margins slightly prominent, sometimes becoming granular sorediose; upper surface smooth, becoming rough and cracked with age; lower surface covered with a dense mat of hyphae right to the margins; hyphae pale brown, branched, anastomosing, septate, to 35  $\mu\text{m}$  thick; upper cortex to 30  $\mu\text{m}$  thick; algal cells scattered throughout the cellular medulla. *Apothecia* one to many per squamule, immersed, to 1 mm diam.; margin not prominent; disk concave to flat, pale reddish-brown; hymenium up to 100  $\mu\text{m}$  tall; paraphyses to 4  $\mu\text{m}$  thick with expanded apices; asci 65-80 x 15-25  $\mu\text{m}$ , 8-spored; ascospores simple, hyaline, ellipsoidal, 15-22(-30) x 6-13  $\mu\text{m}$ .

REACTIONS: Thallus K-, C-, KC-, P-; hymenium I+ pale blue becoming wine red; epihymenium K-.

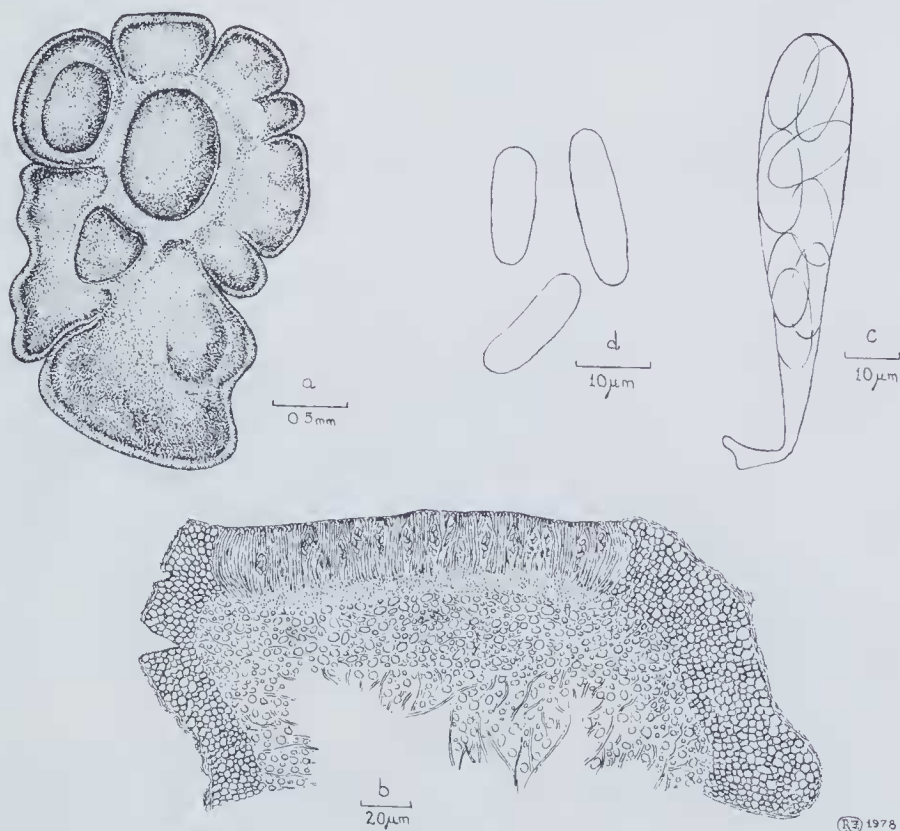


Fig. 1. *Heppia lutosa*. a — thallus from above showing habit. b — section of thallus and apothecium. c — ascus. d — ascospores. From lectotype of *Heppia brisbanensis*, NSW 1286.

## DISCUSSION:

In the field it is difficult to distinguish between the genera *Heppia* and *Peltula*, as macroscopically *H. lutosa* is almost impossible to separate from *P. australiensis* and *P. patellata*. The only positive means of distinguishing between them is with the microscope. In *Heppia* the ascus contains eight spores and does not have a gelatinous sheath (Fig. 1c). *Peltula* on the other hand is polyspored and has a lacerate, gelatinous sheath around the ascus (Fig. 4e). This sheath, however, is indiscernible in some preparations, particularly when the hymenium is difficult to separate.

There is no specimen representative of *Heppia brisbanensis* in Shirley's lichen books in BRI. However, the specimen in NSW has both Shirley's and Wilson's handwriting on the labels, so it seems pertinent to select it as lectotype.

## SELECTED SPECIMENS EXAMINED (total 14):

*Western Australia* - 27 miles SW. of Anna Plains, SW. Broome, 9.viii.1965, A.C. Beauglehole 13956 (MEL 1028846); Point Samson, N. Roebourne, 17.viii.1965, A.C. Beauglehole 14023 (MEL 1028824); Knox Gorge, Hammersley Range, 15.viii.1965, A.C. Beauglehole 14004 (MEL 1028813).

*South Australia* - Tomkinson Ranges, c. 15 km by road E. of Pipalyatjara, 5.ix.1978, N.N. Donner 6717 (MEL 1027035); 15 miles S. of Mt Hopeless Well and Outstation, 11.ix.1966, R.W. Rogers 540 (AD); Lake Torrens Basin, Roxby Downs Station, (c. 120 km NNW. of Woomera, collected from sandy clay soil on top of stony ridge just S. of Centenary Hut, 8.iv.1973, R.D. Seppelt 2442 (AD).

*Queensland* - Red Falls, Lolworth Creek, 58 km WNW. of Charters Towers, on basalt rock on great basalt wall, with scattered trees & shrubs, 21.vi.1986, J.A. Elix 20527 & H. Streimann (ANUC); Lake Julian Road, 20 km NE. of Mt Isa, in sheltered rock crevices in gorge in *Eucalyptus* woodland with *Triodia*, 24.vi.1986, J.A. Elix 20522 & H. Streimann (ANUC); 10 miles S. of Charleville, soil in open Mulga woodland, 12.iv.1972, R.W. Rogers 1965 (BRIU).

## PELTULA

*Peltula australiensis* (Müll. Arg.) R. Filson, Lich. S. Austr.: 142 (1979). - *Heppia australiensis* Müll. Arg., Hedwigia 5: 193 (1892). TYPE: "Ad terram in Western Australia, prope Everard Ranges: Helms n.35". HOLOTYPE: "No.35. West Austral: F.v. Muller 1892 28/5/91 R. Helms" (G!). ISOTYPE: "No 35 28/5/91 R. Helms" (MEL 5780!).

*Thallus squamulose*, terricolous, to 2.5 mm diam., deeply concave or flat; margins smooth, entire or lobed, usually thickened and up-turned; upper surface rugulose, olive-green to brownish-green, sometimes appearing pruinose; pruina yellow or white; lower surface covered with hyphae which penetrate the substrate; hyphae pale brown, septate, branched and anastomosing, to 35 µm thick and 7 mm long; upper cortex 15-20 µm thick; algal layer discontinuous, 90-100 µm thick; lower cortex to 60 µm thick; medulla paraplectenchymatous. *Apothecia* immersed, usually one per squamule but occasionally as many as five, to 1.5 mm diam.; disk flat to convex, pale red to brown to almost black; margin sometimes prominent, sometimes absent; hymenium up to 150 µm tall including the yellow-brown epihymenium; asci 100-126 x 21-24 µm with a thick gelatinous sheath; ascospores numerous in asci, globose, simple, hyaline, 5-8 µm diam.

REACTIONS: Thallus K-, C-, KC-, P-; epihymenium K-; hymenium I+ blue becoming brick-red.

## DISCUSSION:

*Peltula australiensis* has the same general appearance as the other soil-inhabiting species of this group in Australia. It is similar to *P. patellata* and like it varies greatly in thallus size and shape. It can be a small squamule completely dominated by a large apothecium or it can be a large, many-lobed, almost polyphyllous thallus with several immersed apothecia. *P. australiensis* and *P. patellata* can only be separated from each other by the chemical reaction on the epihymenium. There are some minor differences in these species which may prove to be significant over



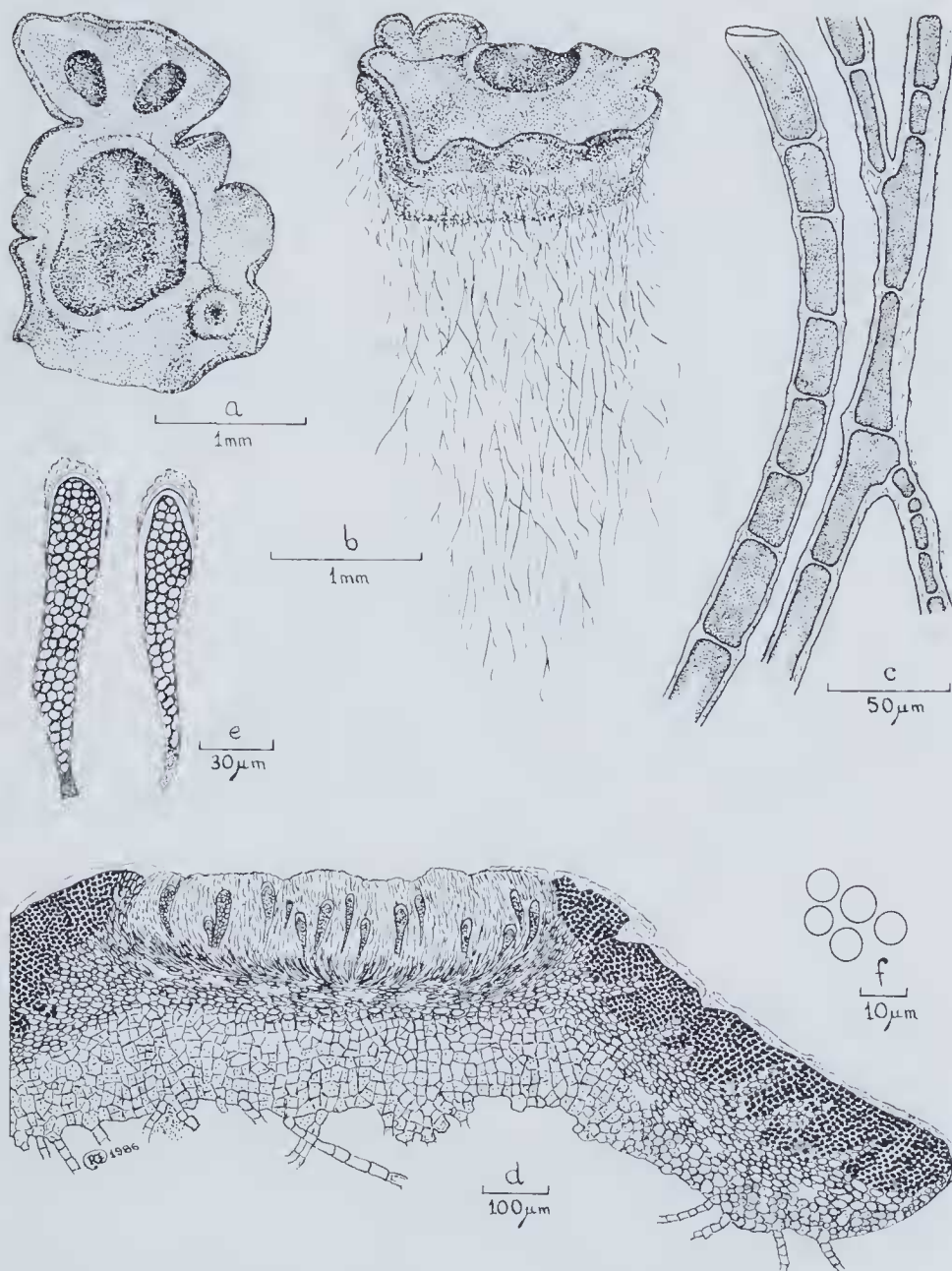


Fig. 2. *Peltula australiensis*. a — thallus from above showing lobed margins and apothecia. b — thallus from side showing branched hyphae penetrating deep into the substrate. c — septate hyphae from the lower surface, showing one branched and anastomosing. d — section through thallus and apothecium. e — asci. f — ascospores. All from MEL 1011768.

a wider range of specimens. The thallus of *P. patellata* appears to be thicker and the apothecia a little larger with higher hymenium, larger asci and larger ascospores. It is possible that these two species could be considered varieties of the one taxon but specimens of both chemotypes have not been collected at the same locality.

SELECTED SPECIMENS EXAMINED (total 13):

*Northern Territory* - On earth on high hill NW. of Alice Springs High School, 14.ix.1965, *J.H. Willis* (MEL 11248); Levi Range, near Wallara Ranch, 17.vii.1968, *A.C. Beauglehole 27145* (MEL 1045790); Mount Olga, 23.iv.1970, *J.R. Brownlie* (MEL 37805).

*South Australia* - By the side of Everard road, 16 miles W. of Stuart Highway, 23.xi.1975, *Rex Filson 15641a & Sue Filson* (MEL 1018606); Wilgena Hill, 6.5 km N. of Kingoonya - Tarcoola road, 67 km W. of Kingoonya, 26.x.1970, *Rex Filson 11929a* (MEL 1018619); Koonamore Vegetation Reserve, 4.viii.1969, *R.W. Rogers 1725* (MEL 1011695).

*New South Wales* - Manara Hills on Mount Manara Station, 66 km N. Ivanhoe, 10.xi.1972, *Rex Filson 14547* (MEL 1011768).

***Peltula bolanderi*** (Tuck.) Wetmore, Ann. Mo. bot. Gdn. 57: 179 (1970). - *Pannaria bolanderi* Tuck., Gen. Lich.: 51 (1872). - *Heppia bolanderi* (Tuck.) Vainio, Acta Soc. Fauna Flora fenn. 7: 215 (1890). - *Pannariella bolanderi* (Tuck.) Gyelnik, Reprium nov. Spec. Regni. veg. 38: 307 (1935). TYPE: "California. Ukiah, on rocks, Bolander 242". HOLOTYPE: on the accompanying label in Tuckerman's writing "California 242 Bolander." and on each of the two specimens "242 Ukiah rare" presumably in Bolander's writing (FH!).

*Thallus* squamulose, saxicolous, usually clustered, peltate, irregularly round to 3 mm diam., monophyllous, attached to the substrate by a central holdfast; margins at first smooth, entire, lobed or slightly lacerate, becoming flexuose, often upturned and sorediate, sometimes with laminal soralia; upper surface olive-green to dark olive-brown, shining, smooth becoming rugulose and cracked with age; soredia farinose to granular, greyish-brown to brownish-black; lower surface smooth to rugulose, pale pinkish-brown to reddish-brown to dark brown; upper cortex to 15  $\mu\text{m}$  thick; algal layer 60-120  $\mu\text{m}$  thick; medulla euthyplectenchymatous; lower cortex 15-30  $\mu\text{m}$  thick. *Apothecia* 1-3 per areolae, punctiform at first, becoming slightly open, to 0.2 mm diam.; disk light yellowish-brown; margin becoming slightly raised at maturity; hymenium 140  $\mu\text{m}$  tall at the centre; asci polyspored, 84-87 x 12-18  $\mu\text{m}$ ; ascospores globose to ellipsoid, simple, hyaline, 3-4 x 4-7  $\mu\text{m}$ . *Pycnidia* spherical, 150  $\mu\text{m}$  diam.; microconidia not seen.

REACTIONS: K -, C -, KC -, P -; epihymenium K -; hymenium I + red.

DISCUSSION:

*Peltula bolanderi* is very similar to *P. euploca* in that it is saxicolous, has small punctiform apothecia and a euthyplectenchymatous medulla. It differs, however, in its habit of growth. The thalli of *P. bolanderi* are much smaller and grow together in clustered colonies and the margins of the thallus are more often upturned and flexuose. Soredia form late so that often in a colony more than half of the thalli are not sorediate. The margins of the apothecia become slightly raised at maturity whereas in *P. euploca* the margin is never raised although the thallus sometimes thickens around the apothecium.

The type is represented on one small pebble and several small fragments glued to two separate paper slips. Both slips are annotated "242 Ukiah rare". The apothecia on these specimens appear to be a little more prominent than those on the other material which I have seen. The apothecia on Australian specimens, although not as prominent as those on the type material, compare favourably with those on extra-Australian specimens determined as this species.

A specimen collected east of Alice Springs (MEL 1017825) appears to be a variant as the thallus, although having a flexuose margin, has very convex thalli which are heavily white-pruinose.

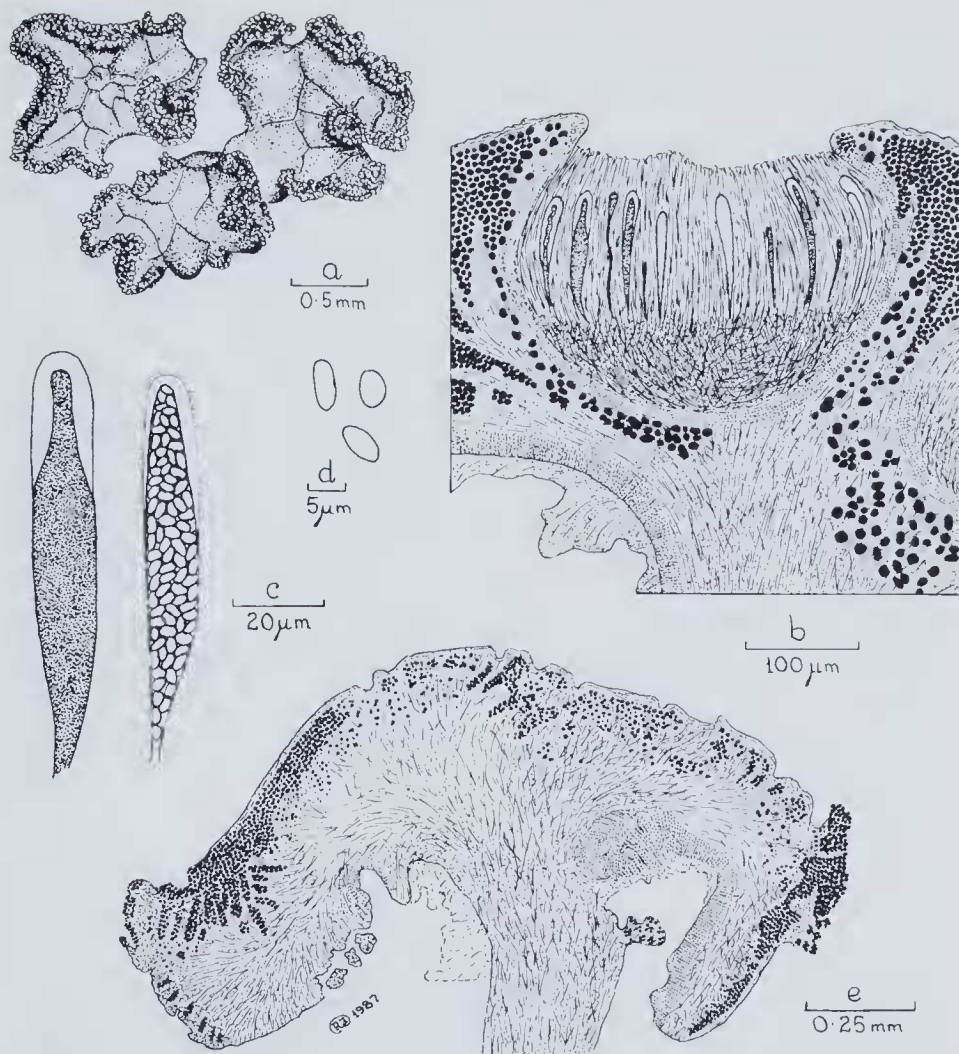


Fig. 3. *Peltula bolanderi*. a — habit of thalli from above. b — section through an apothecium. c — two asci from the hymenium. d — ascospores. e — section through thallus. a, e, from *Elix 11070* (ANUC); b - d, from *Elix 20713* (ANUC).

#### SPECIMENS EXAMINED:

*Western Australia* — 50 km NW. of Mt Elizabeth Station on the track to Bachsten Creek, Central West Kimberlies, 17.vi.1987, *S. Forrester* (MEL 1051644).

*Northern Territory* — W. face of Ayers Rock, on sandstone, 10.ix.1983, *J.A. Elix 11070* & *L.A. Craven* (ANUC); S. facing side of schistose outcrop, 4 km E. Alice Springs, 26.ii.1976, *P.K. Latz 6414* (MEL 1017825).

*South Australia* — By side of road, 16 miles W. of Stuart Highway, Everard Ranges, 23.xi.1975, *Rex Filson 15641* & *Sue Filson* (MEL 1018607).

*Queensland* — Mt. Walker, 15 km S. of Hughenden, on conglomerate rocks in *Eucalyptus* woodland, 25.vi.1986, *J.A. Elix 20723* & *H. Streimann* (ANUC); Cloncurry — Townsville Highway, 18 km ESE. of Cloncurry, in sheltered rock crevices in *Eucalyptus* woodland with *Triodia*, 25.vi.1986, *J.A. Elix 20682* & *H. Streimann* (ANUC).



*Peltula decorticans* (Müll. Arg.) R. Filson, comb. nov. – *Pyrenopsidium decorticans* Müll. Arg., Hedwigia 5: 191 (1892). TYPE: “In West Australia ad saxa silicea: Helms (25.5.1891): no.70”. HOLOTYPE: “No 70. W. Austral. F.v. Mueller 1892 25/5/91 Helms.” (G!). ISOTYPE: “Elder Expl. Exp. 25/5/91 Helms No 70.” (MEL 11100!).

*Heppia placodizans* Zahlbr., Bull. Torrey Bot. Club 35: 299 (1908). – *Endocarpiscum placodizans* (Zahlbr.) Fink, Mycologia 1: 87 (1909). – *Solorinaria placodizans* (Zahlbr.) Gyelnik, Reprim. nov. Spec. Regni. veg. 38: 307 (1935). – *Peltula placodizans* (Zahlbr.) Wetmore, Ann. Mo. bot. Gdn. 57: 196 (1970). TYPE: “On basaltic boulders” [“vicinity of the Desert Botanical Laboratory near Tucson, Arizona. J.C. Blumer, 1908”]. HOLOTYPE: two labels; “Tucson, Arizona 1908 Coll. J.C. Blumer.” and “Coll. J.C. Blumer 112” (W 2984!).

*Thallus* saxicolous, areolate, varying from a small solitary rosette less than 1 cm diam. to continuous patches along cracks several cm long; marginal areoles radiate, placodiform, sublobate, discrete, 0.2-0.5 mm wide, to 1.5 mm long, flat to convex, very variable in thickness; central areoles irregularly round, to 0.6(-1.0) mm diam., flat, convex to hemispheric, sometimes becoming subfruticose, to 2 mm tall; margin smooth, sometimes incised and flexuose; upper surface olive to olive-brown, sometimes appearing pruinose, sorediate; soredia in capitate soralia, dark brown to black; lower surface ecorticate, attached to the substrate by extensions of the medullary tissue, the central areoles stipitate, attached to the substrate by a short holdfast; medulla paraplectenchymatous. *Apothecia* totally immersed in almost hemispheric central areoles; disk colourless or very pale reddish-yellow, punctiform, rarely slightly expanded, emarginate; hymenium to 90  $\mu\text{m}$  tall; asci polyspored, 75-90 x 15  $\mu\text{m}$ ; ascospores hyaline, globose to subglobose to narrowly ellipsoid, 3-8 x 3-4  $\mu\text{m}$  diam. *Pycnidia* not seen.

REACTIONS: Thallus K –, C –, KC –, P –; epihymenium K –; hymenium I + pale blue-green becoming deep reddish-brown.

#### DISCUSSION:

The holotype of *Peltula decorticans* was collected by Richard Helms, biologist on the Elder Exploring Expedition, in the vicinity of Arcoellinna Well, Everard Ranges, South Australia on 25.v.1891. It was sent to J. Müller by Ferdinand Mueller, Government Botanist of Victoria, in 1892.

This species is fairly common on inland acid rocks where it favours the cooler rock faces and sheltered ledges. Its colour varies, being pale olive in sheltered habitats and dark olive-brown in exposed sites. As Wetmore (1970) observed, it is often found in association with *Peltula euploca* and very small thalli of that species are difficult to separate from *P. decorticans*. It may be found growing with *P. zahlbruckneri* and non-sorediate, hemispheric, central areolae of *P. decorticans* can be very similar to those of that species. Some colonies (MEL 1018626) with typical radiate areoles at the margins which are attached to the substrate by extensions from the paraplectenchymatous tissue of the medulla (Fig. 4g), have in the centre several large, flat, peltate squamules, which are attached to the substrate by a holdfast. The colour and texture of the upper surface is seemingly identical; the capitate soredia of the marginal squamules appear indistinguishable from the marginal soredia of some of the central squamules. This, at first, may suggest that these are growth forms of the same taxon. However the species can easily be separated by the structure of the medulla.

Some samples from the Mt Isa region of Queensland (*Elix* 20646, 20661) appear to lack the radiate marginal squamules but the central areolae, though a little larger than typical, structurally agree with the central areolae of *P. decorticans*. One specimen from the Hervey Range (*Elix* 20445) has large central areolae up to 2.0 mm diam. which are affixed to the substrate by a central holdfast. The lower surface and outer layer of the holdfast appear to be corticate, but as the structure



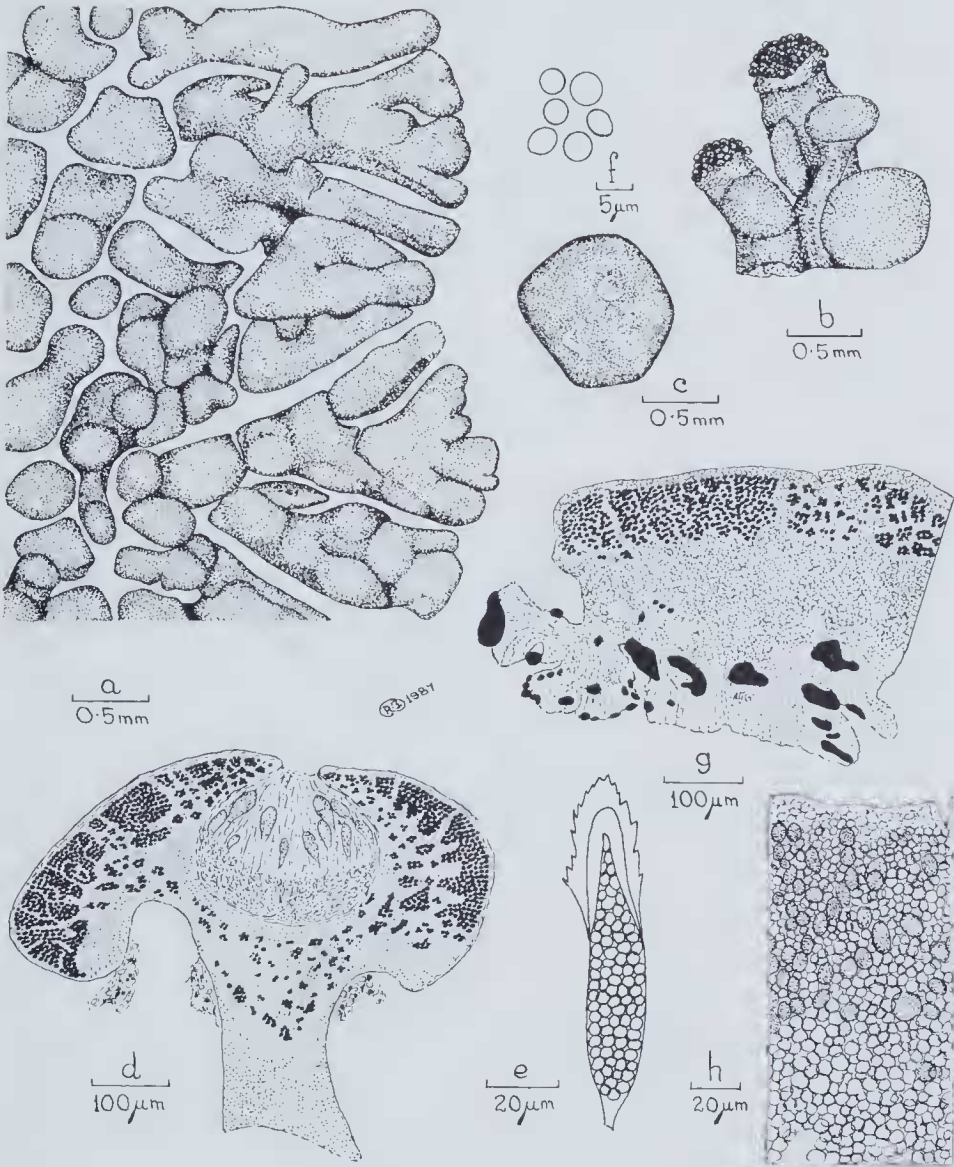


Fig. 4. *Peltula decorticans*. a — portion of the thallus showing radiate marginal areoles and central convex areoles. b — central subfruticose areoles with capitate soralia. c — fertile hemispheric areole. d — section through fertile areole. e — ascus. f — mature ascospores. g — section through marginal areole showing attachment to the substrate by extensions from the medulla. h — enlargement of cortex, algal zone and paraplectenchymatous medulla. a, b, e, f from MEL 1011767; c, d, g, h from MEL 1018107.

of this layer is similar to the paraplectenchymatous medulla it is difficult to ascertain whether it is a true cortex. The marginal areolae are affixed by the medulla and in all other respects the sample agrees with *P. decorticans*. I have hesitated therefore in describing it as distinct until more material becomes available.

The holotype of *Heppia placodizans* Zahlbr. is represented on three rock fragments in Zahlbruckner's herbarium in Vienna. The thalli are lobate-placodiform, sparsely sorediate with capitate, dark brown soralia and are similar in every way to *Peltula decorticans*.

#### SELECTED SPECIMENS EXAMINED (total 13):

*Northern Territory* – Native Gap, Hann Range, 114 km N. of Alice Springs, on protected rock ledges with a southerly aspect, 12.ix.1983, *J.A. Elix 11189b & L.A. Craven* (ANUC); Macdonnell Range, 1 km E. of Pine Gap, in *Acacia* – *Callitris* woodland on sandstone rocks with a southerly aspect, 17.ix.1983, *J.A. Elix 11293 & L.A. Craven* (ANUC).

*South Australia* – Wynbring Rocks, 1.2 km N. Wynbring on Transcontinental Railway Line, 28.x.1970, *Rex Filson 11946* (MEL 1018626); Flinders Ranges, Copley – Balcanoona Road, 13 km E. of Copley, rocky ridge in chenopod shrubland, 30.x.1984, *J.A. Elix 17998 & L.H. Elix* (ANUC); Flinders Ranges, Moralana Gorge Road, 35 km N. of Hawker, in open grassland with stunted *Acacia*, 28.x.1984, *J.A. Elix 17823 & L.H. Elix* (ANUC).

*Queensland* – Mt Farrenden, 26 km SSW. of Charters Towers, on sandstone rocks in dry sclerophyll forest on rocky slope, 22.vi.1986, *J.A. Elix 20581 & H. Streimann* (ANUC); The Maiden Mountain, 40 km WNW. of Bowen, in *Eucalyptus* – *Planchonia* dominated woodland, on granite rocks, 3.vii.1986, *J.A. Elix 21185 & H. Streimann* (ANUC); Lake Julian Road, 20 km NE. of Mt Isa, in sheltered rock crevices in gorge in *Eucalyptus* woodland with *Triodia*, 24.vi.1986, *J.A. Elix 20646 & H. Streimann* (ANUC).

***Peltula euploca*** (Ach.) Poelt ex Ozenda & Clauzade, Les Lichens (Paris): 775 (1970). – *Lichen euplocus* Ach., Lich. Suec. Prod.: 141 (1798). – *Peltula euploca* (Ach.) Poelt, Mitt. Bot. StSamml. Munch. 4: 471 (1962), comb. inval. TYPE: “Sweden, Westring”. HOLOTYPE: “Suecia” (H-ACH 857, photo only seen).

*Endocarpiscum obscurans* Nyl., Bull. Soc. linn. Normandie ser.2, 6: 309 (1872). – *Heppia obscurans* (Nyl.) Nyl. in Hue, Rev. Bot. Bull. Mens. 5: 18 (1886). – *Heppia guépinii* var. *obscurans* (Nyl.) Boist., Nuov. Fl. Lich. 2: 87 (1903). – *Peltula obscurans* (Nyl.) Gyelnik, Reprim nov. Spec. Regni. veg. 38: 308 (1935). TYPE: “Collioure”. LECTOTYPE: (selected Gyelnik 1935): “Pyren. Orient. Collioure W. Nylander 4 Jul 1872” (H-NYL 30897!).

*Thallus* squamulose, usually solitary, saxicolous, peltate, irregularly round to sublobate, to 10 mm diam., usually monophyllous but occasionally polyphyllous, attached to the substrate by a central holdfast of fasciculate hyphae; margins smooth, entire, lobed or slightly lacerate, usually thickened, down-turned and sorediate; upper surface olive-green to brown to almost black, shining or sometimes dull, smooth, becoming rugulose, areolate and cracked in older specimens, sometimes with soredia along the older cracks, sometimes with soralia, the soredia farinose, blue-grey to greyish-brown; lower surface smooth, pale pinkish-brown to red-brown becoming darker toward the margins; upper layer to 120  $\mu\text{m}$  thick, this layer consisting of rounded cortical cells and algal colonies; medulla white, euthyplectenchymatous, loosely compacted; lower cortex to 60  $\mu\text{m}$  thick. *Apothecia* immersed, 1-several per squamule, 0.1-0.7 mm diam.; disk punctiform, reddish-brown, emarginate though sometimes with a thickening of the thallus around the disk; hymenium to 215  $\mu\text{m}$  tall; paraphyses thin, 1.5  $\mu\text{m}$  thick, branched, anastomosing only slightly, thickened at the apical cell; asci 111 x 15  $\mu\text{m}$ , polyspored; ascospores simple, hyaline, subglobose to ellipsoidal, 6-8 x 3-4  $\mu\text{m}$ .

REACTIONS: Thallus K–, C–, KC–, P–; epihymenium K–; hymenium I+ pale blue quickly becoming brownish-red.

#### DISCUSSION:

*Peltula euploca* is the most often collected species of *Heppia* and *Peltula* in Australia. It occurs on both calcareous and acid rocks, in wet and dry habitats.

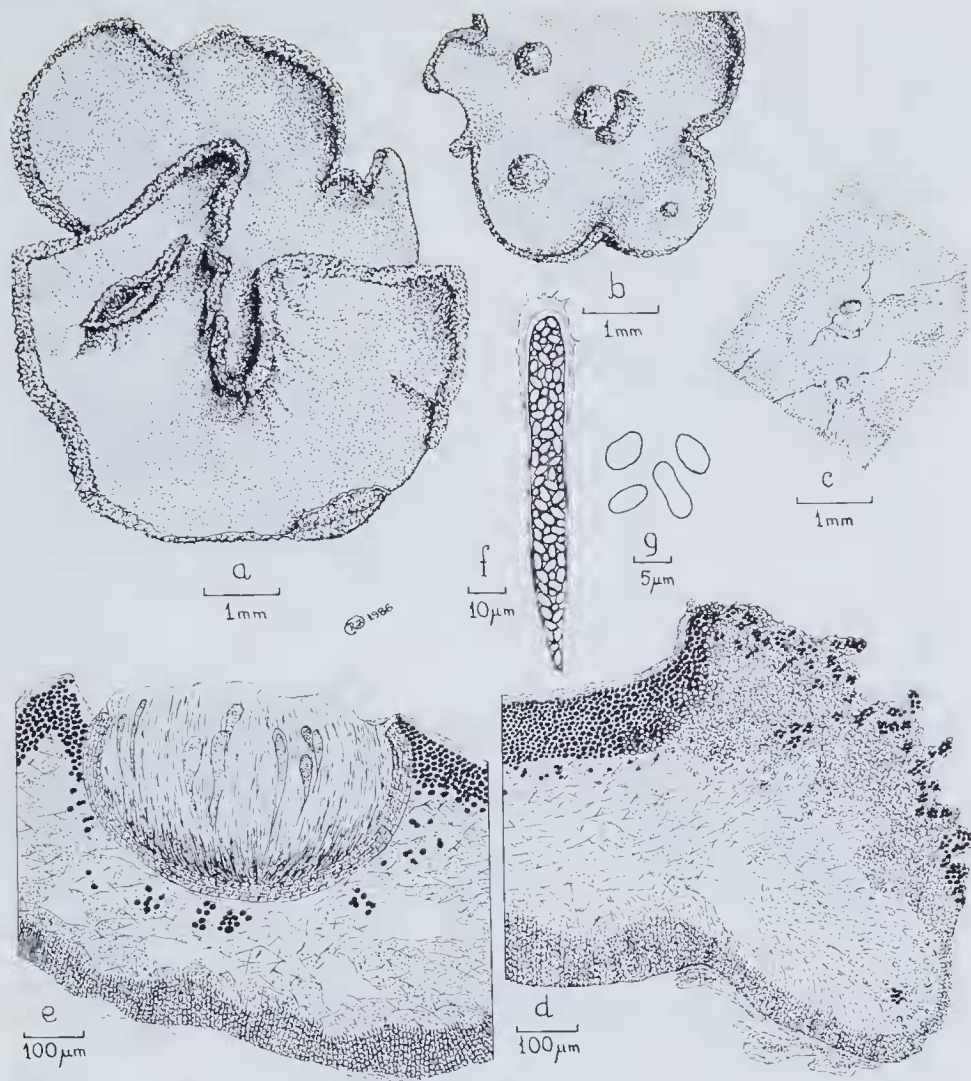


Fig. 5. *Peltula euploca*. a — sterile thallus with sorediose margins. b — portion of thallus lobe showing sorediose margins and hemispheric soralia. c — portion of thallus lobe showing two immersed apothecia. d — section through sorediate margin of thallus. e — section through apothecium. f — ascus. g — spores. a, from MEL 1029256; b, from MEL 1017847; c, from MEL 5781; d, e, from MEL 1018925; f, g, from MEL 1018637.

The thallus is very variable in shape, sometimes being small, to 2 mm diam., almost round, with smooth, thinly sorediose margins, and sometimes greater than 2 mm with flexuose, heavily labriform-sorediate margins. The upper surface is variable in colour, from pale olive-green to grey to almost black, sometimes white pruinose. All forms appear to grade into one another and colonies of one form often have individual thalli of another mixed with them. Thalli are also very variable in size, often as small as 1 mm, but the species is always easily identified by the soredia on the margins, along the cracks in the upper surface or on laminal soralia. Fertile specimens are not common but *P. euploca* is rarely found without soredia.



*Peltula euploca* is very similar to *P. bolanderi* and small thalli are sometimes difficult to separate from those of that species. The upper surface of the thallus of *P. euploca* is always smooth in small specimens whereas in *P. bolanderi* the surface is rugulose and cracked.

Two specimens (*Elix 11183, 11189b*) from the Hann Range, 114 kilometres north of Alice Springs, are atypical. The thalli are to 3 mm diameter, deeply lobed and divided, with sorediose margins which tend to be raised and flexuose. The upper surface is light olive-green and thickly white-pruinose with a distinct dark margin. The form of the thallus is similar to *P. bolanderi* but the thalli are much larger than in that species and are solitary on the substrate. The general appearance of the thallus suggests that a new species may be involved but until more collections become available I prefer to include this material under *P. euploca*.

Gyelnik frequently selected lectotypes without the examination of all relevant syntype specimens and this has led to nomenclatural confusion in several instances. He (Gyelnik 1935) chose H-NYL 30897 as the lectotype of *Endocarpiscum obscurans* Nyl. but Wetmore (1970) rejected this choice and instead chose another specimen H-NYL 30900. Gyelnik's lectotype is undoubtedly *Peltula euploca* and even though Gyelnik discussed the specimen thoroughly, comparing it with *P. guepinii*, he was not certain whether the taxon should, or should not, be considered sorediose. The specimen that he chose as lectotype is sorediose so I cannot find any grounds for overthrowing Gyelnik's choice. Therefore the name *Endocarpiscum obscurans* Nyl. must be placed in synonymy under *Peltula euploca* and another name found for the species currently known (following Wetmore's 1970 interpretation) as *Peltula obscurans* (Nyl.) Gyelnik. The next available name for this taxon is *P. subglebosa* (Müll. Arg.) R. Filson, q.v.

#### SELECTED SPECIMENS EXAMINED (total 64):

*Western Australia* - Quartzite rock at Galvins Gorge, Gibb River Road c. 25 miles N. of turnoff to Mt House H.S., 25.vii.1974, *J.H. Willis* (MEL 515454); Carson Escarpment, c. 40 km S. of Carson River Homestead in Drysdale River National Park, N. Kimberlies, 10.vi.1984, *J.H. Willis* (MEL 1050511 pr. p.); Wapet road, 21° 00' S., 123° 10' E., -i.1980, *A.S. Mitchell 1102 pr. p.* (MEL 1026834).

*Northern Territory* - Mulga Park on Ernabella-Mulga Park road, 26.vi.1965, *A.C. Beauglehole 13602* (MEL 1018106); S. facing slope of quartzite hill, Blatherskite Range, Alice Springs, 26.ii.1976, *P.K. Latz 6399* (MEL 1017856); S. facing slope of sandstone hill, 25 km SW. Alice Springs, 24.ii.1976, *P.K. Latz 6389* (MEL 1017838); S. facing side of shistose rock outcrop, 4 km E. Alice Springs, 26.ii.1976, *P.K. Latz 6409* (MEL 1017847); N. side of the lower falls, Edith Falls, 20.vii.1965, *A.C. Beauglehole 13791* (MEL 1018637).

*South Australia* - Murrawidginnie Cave No.2, 6 miles N. of Eyre Highway, 7.i.1952, *D.S. Kemsley* (MEL 1011697); Rocky outcrop N. of Ernabella road, 4 miles W. of Kenmore Park Homestead, Musgrave Ranges, 26.xi.1975, *Rex Filson 15698 & Sue Filson* (MEL 1018604); Illbillie area, Everard Ranges, 24.vi.1965, *A.C. Beauglehole 13579* (MEL 1018634); 3 km N. of Kokatha on the Poochera-Kingoonya road, 26.x.1970, *Rex Filson 11911* (MEL 1018621); Waukaringa mines near Koonmore road, 18.xii.1969, *R.W. Rogers 1822* (MEL 1011686).

*New South Wales* - Lower slopes of the Wedding Cake, Yodellers Ridge, Widden Valley, 16.iv.1979, *Rex Filson 16682* (MEL 1027838); Prope Jenolan Caves, 9.ix.1897, *F.R.M. Wilson* (NSW L2941); 9 miles E. of Cooma on the Numeralla road, 2.xii.1965, *Rex Filson 7896* (MEL 1021165).

*Australian Capital Territory* - Gudgenby Gorge, 4 km S. Tharwa, 26.vii.1979, *Rex Filson 16753* (MEL 1516130).

*Victoria* - Rowsley on the Parwon River, 3 miles S. of Bacchus Marsh, 27.xii.1901, *R.A. Bastow* (MEL 5781); On basaltic rocks, Little River, 26.i.1897, *F.R.M. Wilson* (NSW L2943); Braybrook, 18.x.1900, *R.A. Bastow* (MEL 5783); On rocks in stony outcrop 2-3 miles SSW. Beeac, 8.ii.1952, *A.C. Beauglehole 3241* (MEL 10233390); Dinky Cove, Lady Julia Percy Island Wildlife Reserve, 28.xii.1974, *A.C. Beauglehole 73415* (MEL 1045757); Point Wilson, 15 km NE. Geelong, -iii.1980, *Anne Geddes* (MEL 1029253).

*Tasmania* - Meadowbanks Road near Hamilton, 12.vii.1970, *G.C. Bratt & J.A. Cashin 70/807* (MEL 1011687).

#### *Peltula imbricata* R. Filson, sp. nov.

*Thallus* imbricatus, ad 10 mm diam., lobus concavus, ad 0.7 mm diam. *Apothecia* adnata, ad 0.7(-1.0) mm diam., margine conspicuo, asci polyspori, ascosporae hyalinae, oblongo-ovoideae 6-7 x 3 µm.

*Thallus* terricolous, of small imbricate lobes, tightly appressed to the substrate, forming small colonies or a continuous crust to 10 mm diam.; lobes concave, to

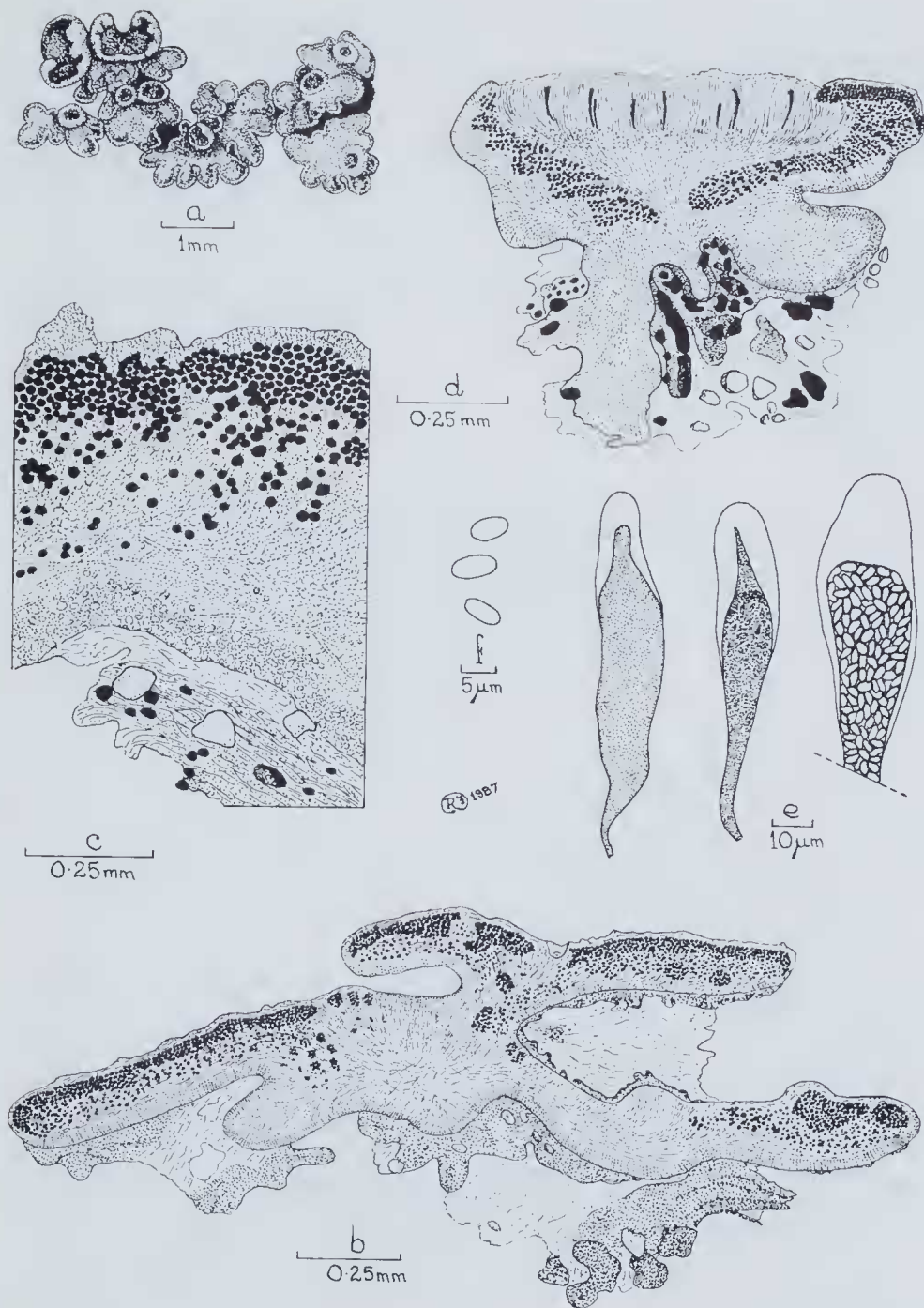


Fig. 6. *Peltula imbricata*. a — thallus from above showing general habit. b — section through portion of thallus showing imbricate lobes. c — enlargement of portion of thallus section showing parlectenchymatous tissue in the upper portion of the medulla and euthyplectenchymatous tissue in the lower. d — section through apothecium. e — three asci from the hymenium. f — ascospores. All from the holotype, MEL 1050656.

0.7 mm diam.; upper surface smooth, olive-green, sometimes appearing pruinose; pruina pale yellow or white; margins smooth, olive-brown, epruinose, slightly raised; lower surface corticate, pale pink to pinkish-brown, attached by thick cords which penetrate deep into the substrate; upper cortex to 12  $\mu\text{m}$  thick; medulla moderately to loosely compacted, euthyplectenchymatous; lower cortex to 30  $\mu\text{m}$  thick. *Apothecia* sessile, to 0.7(-1.0) mm diam.; margin thick, concolorous with the thallus; disk reddish-brown; hymenium to 120  $\mu\text{m}$  tall; paraphyses thin, 1.0  $\mu\text{m}$  thick, conglomerate; apical cell expanded to 4  $\mu\text{m}$ ; asci polyspored, 78-90 x 22-27  $\mu\text{m}$ ; ascospores hyaline, ellipsoid, 6-7 x 3  $\mu\text{m}$ . *Pycnidia* not seen.

HOLOTYPE: Macdonnell Range, 1 km E. of Pine Gap, 23° 49' S., 133° 45' E., in *Acacia - Callitris* woodland on soil, 17.ix.1983, J.A. Elix 11319 & L.A. Craven (MEL 1050656). PARATYPE: Hillside Simpsons Gap National Park, rare on soil pocket between boulders, 23° 42' S., 133° 42' E., 11.iii.1976, P.K. Latz 6540 (MEL 1017812).

REACTIONS: Thallus K -, C -, KC -, P -; epihymenium K - or + yellow; hymenium I+ deep blue.

#### DISCUSSION:

This new species is very distinctive and readily identifiable in the field by its small congested imbricate lobes. The medulla varies from being paraplectenchymatous in the upper parts of the thallus and at the tips of the lobes to moderately to loosely euthyplectenchymatous in the thicker parts of the thallus.

#### FURTHER SPECIMEN EXAMINED:

Northern Territory - Sheltered area on S. scree slope of quartzite hill, Blatherskite Range, Alice Springs, rare amongst moss, 23° 46' S., 133° 52' E., 26.ii.1976, P.K. Latz 6402 (MEL 1017842).

*Peltula omphaliza* (Nyl.) Wetmore, Ann. Mo. bot. Gdn. 57: 194 (1970). - *Heppia omphaliza* Nyl. in Eckf., Bull. Torrey Bot. Club. 16: 106 (1889). - *Endocarpiscum omphalizum* (Nyl.) Müll. Arg., Hedwigia 34: 28 (1895). TYPE: "Mexico. Gulf of California, island of San Pedro Martin, Palmer 1887". HOLOTYPE: Outside of packet "California Eckfeldt." and on the label in the packet "20 Heppia sp novo Lower California rocks near the sea J.W. Eckfeldt" (H-NYL 30893!).

*Thallus* saxicolous, squamulose, peltate, irregularly round, to 2 mm diam., flat to slightly convex; margins smooth, entire or slightly lobed; upper surface olive-green to pale brown with a darker brown margin, smooth, dull or occasionally slightly shining; lower surface smooth to wrinkled, sometimes distinctly ridged, pale buff with one or more holdfasts attaching the squamule to the substrate, sometimes when growing on a loose substrate the lower surface is thickly covered with pale brown hyphae; upper layer thick, almost filling the areole; medulla thin, euthyplectenchymatous. *Apothecia* solitary or several per squamule, immersed; disk at first punctiform, later expanding to 0.75 mm diam., without a thalloid margin or sometimes an expanded apothecium almost fills an areolae and then the margin appears thalloid; hymenium to 150  $\mu\text{m}$  tall; asci 60-90 x 21-27  $\mu\text{m}$  with a gelatinous sheath, polyspored; ascospores globose to ellipsoidal, hyaline, simple, 5-7 x 3  $\mu\text{m}$ . *Pycnidia* globose, immersed in the thallus; microconidia not seen.

REACTIONS: Thallus K -, C -, KC -, P -; epihymenium K - or K + red; hymenium I+ blue becoming red.

#### DISCUSSION:

*Peltula omphaliza* is very common on limestone rocks and on pebbles lying on the ground. In some forms it is difficult to separate from *P. euploca* and *P. zahlbruckneri*. However, the thallus is never sorediate, always squamulose, peltate



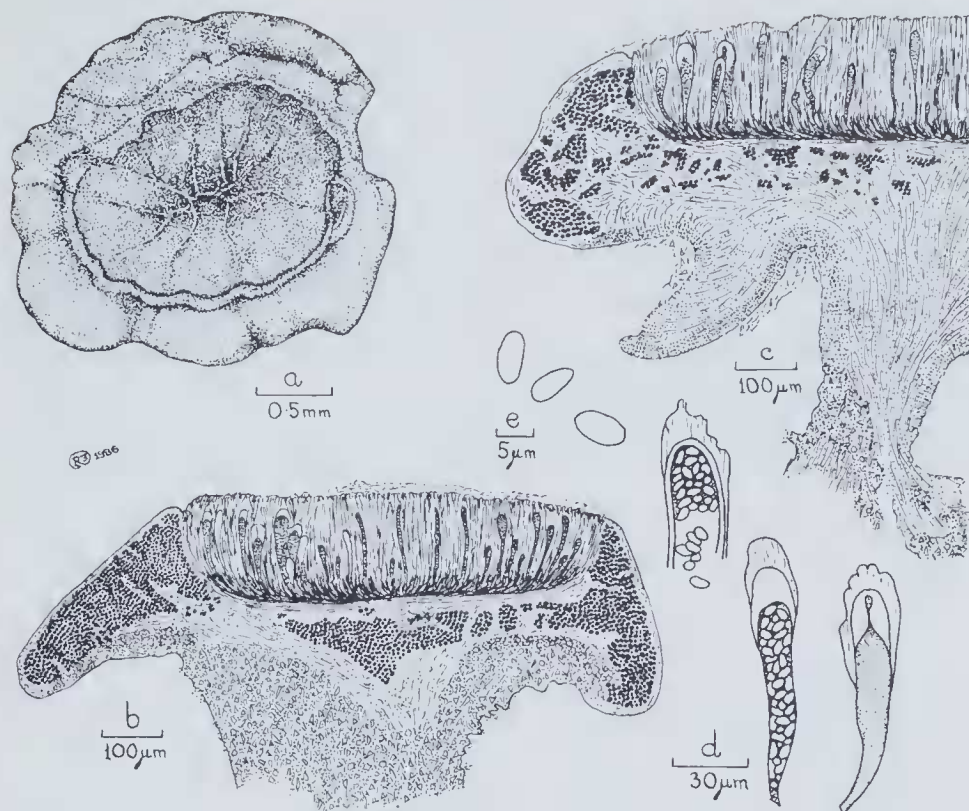


Fig. 7. *Peltula omphaliza*. a — thallus from above, showing one large apothecium almost covering the areole. b — section through thallus showing apothecium and holdfast, outer layer of holdfast heavily embedded with crystals from the substrate. c — section through portion of thallus showing apothecium, ridged lower surface and holdfast. d — asci from the hymenium, on the left is a broken mature ascus. e — ascospores. a, b, d, e, from MEL 1021176; c, from MEL 1047118.

and flat to slightly convex on top and the squamules have an undulate to flexuose margin. At most times *P. omphaliza* has a fairly large, expanded apothecium, whereas the apothecia of *P. euploca* and *P. zahlbruckneri* are always immersed and punctiform. These three species all have a euthyplectenchymatous medulla.

#### SELECTED SPECIMENS EXAMINED (total 7):

*Western Australia* — Giles Meteorological Station, Rawlinson Ranges, c. 1966, Noel Barrett (MEL 1011696).

*Northern Territory* — George Gill Range, Carmichael Crag, 9.iii.1968, A.C. Beaglehole 26400 (MEL 1046347); near old Angus Downs Station H.S., 12.ix.1965, J.H. Willis (MEL 11250); Ooraminna Rock Hole, 40 km S. of Alice Springs, 26.vii.1968, A.C. Beaglehole 27718 (MEL 1047118).

*South Australia* — Everard Ranges, Mt Illbillie area, 28.vi.1968, A.C. Beaglehole 25622 (MEL 1046344); NW. Plains, Serpentine Lakes (Serpentine Lakes are c. 250 km N. of Deakin on the Transcontinental Railway), 19.vii.1972, N.N. Donner 3959 (AD 97807134).

***Peltula patellata*** (Bagl.) Swinscow & Krog, *Norw. J. Bot.* 26: 221 (1979). — *Acarospora patellata* Bagl. *Nuov. Giorn. Bot. Ital.* 7: 245 (1875). — *Heppia patellata* (Bagl.) Stizenb., *Ber. Th. St Gall. naturw. Ges.* 1889-90: 190 (1890). TYPE: “Ad saxa granitica decomposita montis *Deban*.” HOLOTYPE: “Abissinia settentrionale,

paese dei Bogos, Abita, Keren, sul Mte Deban fra i 4500 e i 5500 p, O. Beccari 74, 1870" (FI n.v.).

*Peltula polyspora* (Tuck.) Wetmore, Ann. Mo. bot. Gdn. 57: 198 (1970). – *Heppia polyspora* Tuck., Syn. N. Amer. Lich. 1: 115 (1882). – *Endocarpiscum polysporum* (Tuck.) Fink, Contr. U.S. natn. Herb. 14: 149 (1910). TYPE: "Mountains of Colorado, T.S. Brandege; comm. by C.J. Sprague." HOLOTYPE: Two labels "Sierra Sangre de Cristo Colorado. Coll. T.S. Brandege." and "Colorado Brandege (comm. C.J Sprague) 4 1879" (FH!).

*Thallus* squamulose, terricolous, to 2.5 mm diam., at first flat, becoming deeply concave; margins smooth, entire or lobed, usually thickened and up-turned and slightly raised and often darker in colour; upper surface smooth to rugulose, olive-green to brownish-green, sometimes appearing pruinose; pruina white or yellow; lower surface covered with dense hyphae; hyphae pale brown, branched, anastomosing, septate, to 35  $\mu\text{m}$  thick and 7 mm long, penetrating deeply into the substrate. *Apothecia* immersed, 1-8 per squamule, to 1 mm diam.; margin absent at first, becoming prominent at maturity; disk open, reddish-brown; hymenium 126  $\mu\text{m}$  tall including the yellow-brown epihymenium; asci polyspored, 105-110 x 30-33  $\mu\text{m}$  with a thick gelatinous sheath; ascospores spherical, hyaline, simple, 3-7  $\mu\text{m}$  diam.

REACTIONS: Thallus K–, C–, KC–, P–; epihymenium K+ red, l+ red; hymenium I+ blue becoming brick-red.

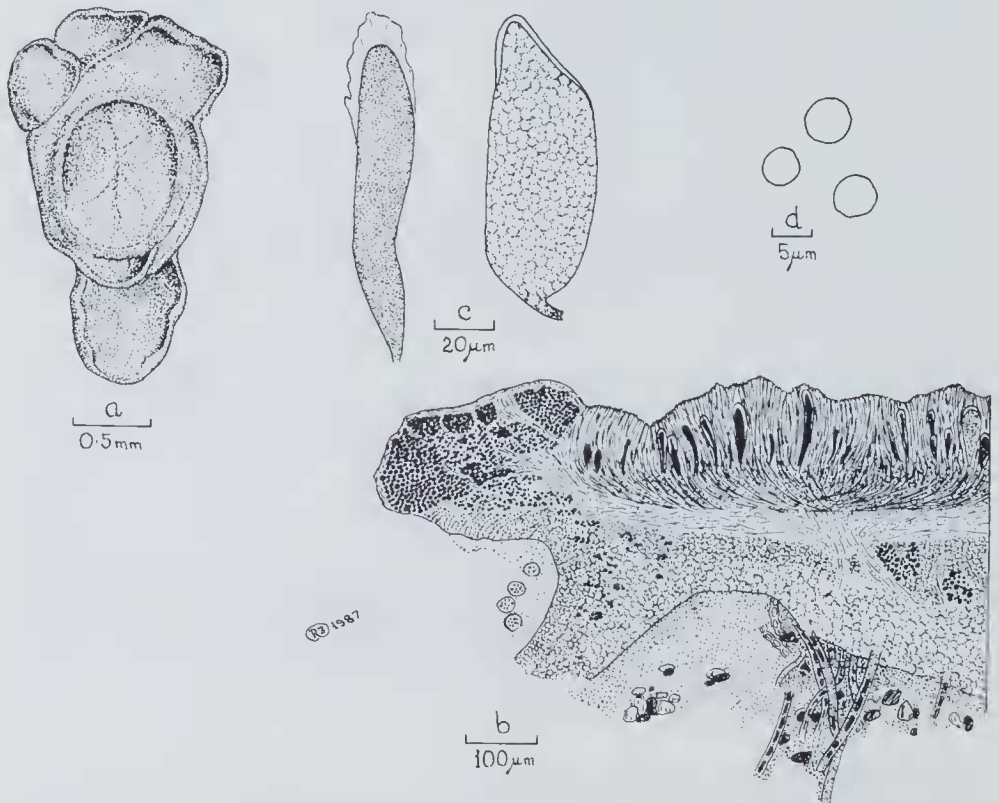


Fig. 8. *Peltula patellata*. a — habit. b — section through part of thallus. c — asci from the hymenium. d — ascospores. a, c, d, from MEL 1020677; b, from MEL 1027028.

## DISCUSSION:

Swinscow and Krog (1979) discussed the holotype of *Acarospora patellata* Bagl. saying that it was of poor quality, consisting of a few squamules on crumbling rock. I have not seen this specimen but have accepted Swinscow and Krog's interpretation. The protologue and illustration of spores of *A. patellata* (Baglietto 1875) certainly suggest that that name and *P. polyspora* are synonymous.

## SELECTED SPECIMENS EXAMINED (total 21):

*Western Australia* - 5 miles N. of Giles Creek on Sandy Blight Road, soil in Mulga-*Aristida contorta* shrubland, 23.ix.1969, J.R. Maconochie (BRIU).

*Northern Territory* - Tanami Desert Wild Life Sanctuary, The Granites, c. 525 km NW. Alice Springs, 19.v.1976, A.C. Beauglehole 50914 (MEL 1045796); Ayers Rock, growing around the base of the rock, 5.vii.1968, A.C. Beauglehole 25881 (MEL 1045785).

*South Australia* - 6 miles E. of Kingoonya, 23.ii.1966, R.W. Rogers 185 (AD); 8 miles W. of Yunta, 12.ii.1966, R.W. Rogers 119 (AD); Tjatamanga Rockhole, c. 18 km by road SE. of Cheesman Junction, beside the road to Emu Junction, 27° 25' S., 130° 25' E., abundant in wet sand near waterhole and edges of rock outcrop, 27.viii.1978, N.N. Donner 6379 (MEL 1027028).

*Queensland* - Red Falls, Lolworth Creek, 58 km WNW. of Charters Towers, on basalt rock on great basalt wall, with scattered trees & shrubs, 21.vi.1986, J.A. Elix 20523 & H. Streimann (ANUC); Lake Julian Road, 20 km NE. of Mt Isa, in sheltered rock crevices in gorge in *Eucalyptus* woodland with *Triodia*, 24.vi.1986, J.A. Elix 20647 & H. Streimann (ANUC).

*New South Wales* - 70 miles S. of Bourke, 30.xi.1966, R.W. Rogers 894 (AD).

***Peltula subglebosa* (Müll. Arg.) R. Filson, comb. nov.**

BASIONYM: *Placodium subglebosum* Müll. Arg., Flora, Jena 72: 510 (1889).

- *Acarospora subglebosa* (Müll. Arg.) Hue, Nuov. Arch. Mus. ser. 5, 1: 162 (1909).

- *Heppia subglebosa* (Müll. Arg.) M. Lamb, An. Parq. Nac. B. Aires 7: 48 (1958)(1959). TYPE: "Saxicola ad Rio Negro et R. Colorado." LECTOTYPE: (here chosen): "Riv Negro, Sud-Argentimin: Dr. Lorentz. 1882." (G!); REMAINING SYNTYPE: "Riv Colorado, Sudargentimin: Dr. Lorentz. 1882." (G!).

*Heppia acarosporoides* Müll. Arg., Hedwigia 31: 194 (1892). TYPE: "Ad terram in Western Australia, Camp 1: H. sine no". HOLOTYPE: "West Austral., Camp 1 & 2 Helms 7.6.91. F.v. Mueller 1892" (G!).

*Heppia hassei* Zahlbr., Beih. bot. Zbl. 13: 157 (1902). TYPE: "Ad saxa granitica, Palm Springs [Hasse no. 817 et 827]." LECTOTYPE (selected Wetmore 1970): "Hasse: Lichen Californiae no. 817. Heppia Hassei A. Zahlbr. Palm Springs, ad saxa granitica." (W!).

*Heppia deserticola* Zahlbr., Bull. Torrey Bot. Club 35: 300 (1908). TYPE: "On basaltic boulders". HOLOTYPE: (n.v.). ISOTYPE: "Southward facing tuff, Tucson, Arizona, Station 111 March 1908. J.C. Blumer." (Herb Bruce Fink 5967 MICH!).

*Heppia deserticola* var. *minor* Zahlbr., Ann. Mycol. 7: 474 (1909). TYPE: "Arizona, Tucson, an Basaltfelsen (J.C. Blumer)". HOLOTYPE: (n.v.). ISOTYPE: "on rocks, Tucson, Arizona, March 1908 J.C. Blumer." (MICH!).

[*Peltula obscurans* sensu Wetmore (1970), non (Nyl.) Gyelnik (1935) - see synonymy and discussion under *P. euploca*.]

*Thallus* squamulose, saxicolous and terricolous, to 1.5 mm diam., concave, flat or slightly convex; margins thickened, irregularly lobed to flexuose, sometimes becoming almost upright, sometimes appearing polyphylous; upper surface smooth to rugulose, olive-green to olive-brown, sometimes appearing pruinose, pruina yellow; lower surface sometimes covered with thick, pale hyphae, sometimes with a thick, branched, central cord surrounded by thinner hyphae, which penetrate deep into the substrate; medulla paraplectenchymatous in the outer region, becoming euthyplectenchymatous in the centre. *Apothecia* one per squamule, immersed at first, becoming sessile; margin often prominent; disk to 1 mm diam., red-brown; hymenium to 90  $\mu$ m tall including the pale yellow-brown epihymenium; paraphyses branched, anastomosing, to 1  $\mu$ m thick, slightly expanded at the apical cell; asci polyspored, 60-75 x 15-18  $\mu$ m; ascospores irregularly ellipsoid, simple, hyaline, 7-10 x 3-5  $\mu$ m. *Pycnidia* immersed, irregularly vesicular; microconidia ellipsoid-fusiform, 3-4 x 1.5-2  $\mu$ m.



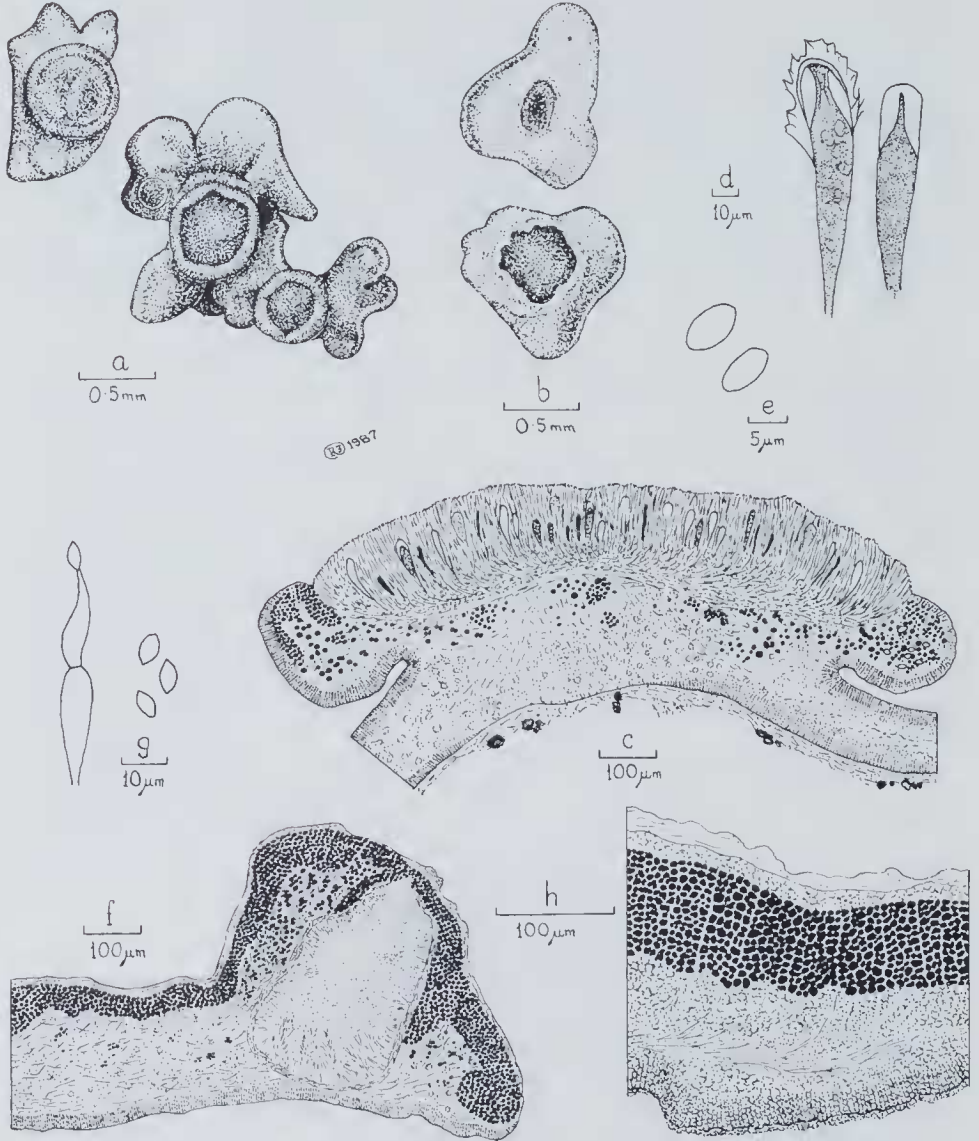


Fig. 9. *Peltula subglebosa*. a — habit showing sessile apothecia with prominent margin. b — habit, the upper thallus shows a young immersed apothecium whilst the lower thallus shows the margin becoming thicker and more prominent. c — section through an apothecium. d — asci from the hymenium. e — ascospores. f — section through the thallus showing a pycnidium. g — conidia-bearing hyphae from the pycnidium (microconidia on right drawn a little larger). h — enlarged section of the thallus showing paraplectenchymatous tissue with a thin band of euthyplectenchymatous tissue in the centre of the medulla. a, c - h, from MEL 1047125; b, from MEL 1020680.

REACTIONS: Thallus K – , C – , KC – , P – ; epihyemium K – or K + red; hymenium I+ pale blue becoming red.

#### DISCUSSION:

When collected from soil *Peltula subglebosa*, like the other soil-inhabiting species in this group, is difficult to determine in the field as the formation of the thallus is similar in all species with the exception of *P. imbricata*. However, microscopically it is easily separated from *P. australiensis* and *P. patellata* by its small elliptical spores and from *Heppia lutosa* by its polyspored ascus.

The holotype of *Heppia acarosporoides* Müll. Arg. is represented on four small limestone pebbles. There are only a few squamulose thalli present and these agree with other small thalli of *P. subglebosa*. The specimens were collected in South Australia, not Western Australia as stated in the protologue and on the specimen. Richard Helms was botanist on the Elder Exploring Expedition of 1891-92 and the label data suggests that this gathering was made either at Camp 1, at the eastern end of Mount Illbillie, in the Everard Ranges or at Camp 2, a granite outcrop at the western end of the Everard Ranges. The date "7.6.91." is also on the label, and on that day the party travelled between Camp 1 and Camp 2 crossing "undulating sandy country with high granite hills . . . The last two miles were sandy, mulga, brooms, acacia, . . ." (Lindsay 1893:28). The following day, 8.6.1891, they departed westward from Camp 2 crossing "undulating sandy country, with an occasional granite rock just showing and limestone rises with hard soil . . . marked a large gum tree where we crossed the Ferdinand [River] D.L. [David Lindsay, leader of the expedition] 7.6.91" (Lindsay loc.cit.). From this account it would appear that they were a day out of sequence on the expedition and it is possible that this specimen was collected on the 8.6.1891 on the limestone rises to the west of the Everard Ranges, South Australia.

Wetmore (1970) included two species as varieties under *Peltula obscurans* (Nyl.) Gyelnik. One, *Heppia hassei* Zahlbr., is described from Palm Springs, California. The type is represented on three granite chips, the smallest annotated "Lectotype of *H. hassei*". Only one sterile squamule remains on this chip and this agrees with the small rosulate squamules on the other two chips. The other species, *Heppia deserticola* Zahlbr., is one of several described from near the Botanical Laboratory, Tucson, Arizona. The isotype in the University of Michigan is represented on two small pebbles. Only one and a half mature thalli remain on one of these pebbles. I can see no valid criteria by which to separate these species from *P. subglebosa*.

The isotype of *Heppia deserticola*; var. *minor* Zahlbr. was also collected in the vicinity of the Botanical Laboratory, Tucson. This species is also represented on two fragments of stone, on which many thalli of *P. subglebosa* and *P. euploca* are found.

#### SPECIMENS EXAMINED:

*Western Australia* – Knox Gorge, Hammersley Range, 15.viii.1965, *A.C. Beauglehole 14005* (MEL 1028814); Hammersley Range, Yamphire Gorge, 9 miles S. of Wittenoom on the Roy Hill Road, 15.viii.1965, *A.C. Beauglehole 14012* (MEL 1028812).

*Northern Territory* – near Mt Palmer, Harts Range, 14.vii.1965, *A.C. Beauglehole 13742* (MEL 1028860); George Gill Range, Penny Springs Area, 14.viii.1968, *A.C. Beauglehole 26880* (MEL 1047125); 120 miles W. of Ayers Rock, soil on stony outcrop with Mallee vegetation, 17.ix.1969, *J.R. Maconochie* (BRIU); George Gill Range, Carmichael Crag, 24° 13' S., 131° 33' E., 14.viii.1968, *A.C. Beauglehole 26880* (MEL 1047125).

*South Australia* – Koonamore Vegetation Reserve, on sandy slopes of an arid dune, 7.vii.1969, *R.W. Rogers 1725* (BRIU); Flinders Ranges, 4.5 km S. Beltana, on rocky ridge in Chenopod shrubland, 30.x.1984, *J.A. Elix 17975 & L.H. Elix* (ANUC); Appreetinna Creek, 25 km N. Mount Willoughby Station, on conglomerate in *Acacia* scrub, 9.ix.1983, *J.A. Elix 11051 & L.A. Craven* (ANUC); Mt Davies Camp, Pipalyatjara Aboriginal settlement, 26° 10' S., 129° 08' E., rock outcrop above camp, moist shady position between rocks, 3.ix.1978, *N.N. Donner 6721* (MEL 1027050).

*Queensland* – Red Falls, Lolworth Creek, 58 km WNW. of Charters Towers, on basalt rock on great basalt wall, with scattered trees & shrubs, 21.vi.1986, *J.A. Elix 20526 & H. Streimann* (ANUC); 10 miles S. of Charleville, soil in open Mulga woodland, 12.iv.1972, *R.W. Rogers 1965*; (BRIU).

*Peltula zahlbruckneri* (Hasse) Wetmore, Ann. Mo. bot. Gdn. 57: 205 (1970). - *Heppia zahlbruckneri* Hasse, Bryologist 14: 100 (1911). TYPE: "On quartz in Rubio Cañon, San Gabriel Range, near Pasadena, the type locality. Collected by Mr. C.C. Kingman." HOLOTYPE: "Californica, Rubio Cañon, Sca Gabriel Gebirge bei Paratena. Leg. C.C. Kingsmann com. Hasse." (W!). ISOTYPES: "[Zahlbruckner exs. no.] 1965. America borealis (California): Rubi Cañon in montibus San Gabriel, Los Angeles Co.. ad saxa quartosa (specimina originalia). Leg. H.E. Hasse." (BRI 230314!, W!).

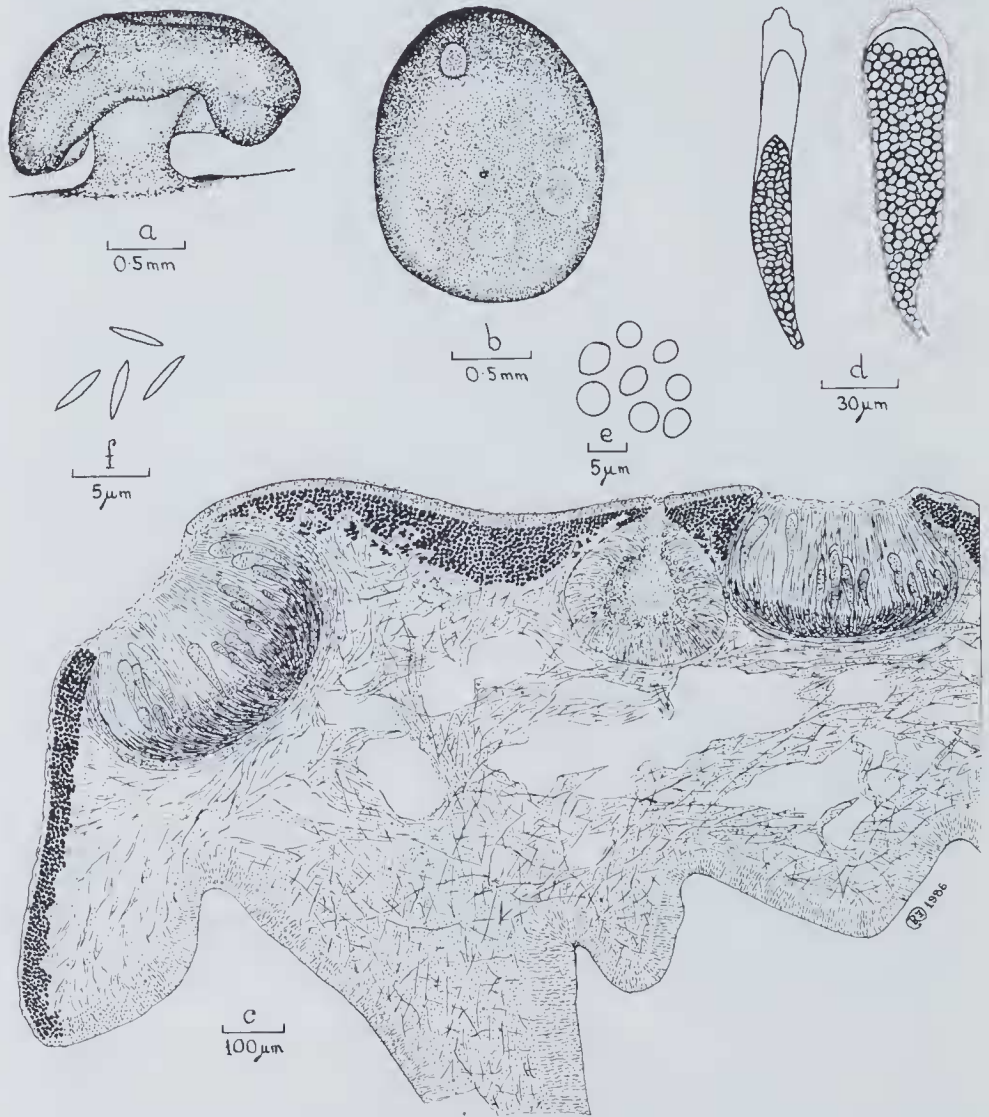


Fig. 10. *Peltula zahlbruckneri*. a — side view of thallus showing holdfast. b — thallus from above. c — section of thallus showing apothecia and a pycnidium. d — asci. e — ascospores. f — microconidia. All from MEL 1018612; a, b, drawn from wet material.





Fig. 11. Known distribution of *Heppia* and *Peltula* in Australia. a — *Heppia lutosa*. b — *Peltula australiensis*. c — *P. bolanderi*. d — *P. decorticans*. e — *P. euploca*. f — *P. imbricata*. g — *P. omphaliza*. h — *P. patellata*. i — *P. subglebosa*. j — *P. zahlbruckneri*.

*Thallus* saxicolous, of subfruticose squamules aggregated into groups, 1-3 mm tall, upper part expanded to 3 mm wide, round, ellipsoidal, or misshapened by pressure, attached to the substrate by a central holdfast; upper surface smooth,

non sorediate, non isidiate, olive-green to dark olive-brown, dull, sometimes lightly pruinose, sometimes slightly shining, flat on top when dry, slightly convex to inflated when wet; lower surface smooth, yellowish-brown; upper cortex to 12  $\mu\text{m}$  thick; algal layer discontinuous, to 75  $\mu\text{m}$  thick; lower cortex to 75  $\mu\text{m}$  thick; medulla euthyplectenchymatous, loose with many hollow areas. *Apothecia* several per squamule, immersed, to 0.25 mm diam.; disk punctiform, enlarging with age, reddish-brown, shining; margin not prominent; hymenium to 300  $\mu\text{m}$  tall; asci polyspored, 150 x 24  $\mu\text{m}$  with a gelatinous sheath; ascospores globose to subglobose, hyaline, simple, 3.5-5(-7)  $\mu\text{m}$  diam. *Pycnidia* immersed, spherical, to 400  $\mu\text{m}$  diam., contents in heavy gel which is difficult to separate; microconidia fusiform, 3-4 x 1  $\mu\text{m}$ .

REACTIONS: Thallus K - , C - , KC - , P - ; epihymenium K - ; hymenium I + red.

#### DISCUSSION:

Wetmore (1970) says that as the collection was attributed to Hasse, specimens in the Crypt. Vind. Exsic. 1965 distributed by Zahlbruckner cannot be type material. I agree that the holotype is most definitely that labelled as being collected by Kingmann (W!) but can see no reason why Zahlbruckner's exsiccata specimens are not isotypes. Hasse (1911) says "Type deposited with Dr. A. Zahlbruckner and type duplicate in Herb. Hasse." It seems reasonable that if the type material was ample that Zahlbruckner would distribute the extra material in his exsiccata; hence he annotated "specimina originalia" to portions of the type material, i.e. isotypes, but incorrectly attributed the collection to Hasse. The lichen material and rock substrate of the W and BRI exsiccata specimens appear indistinguishable from those of the holotype.

#### SPECIMENS EXAMINED:

*Northern Territory* - Lower slopes around the edge of Ayers Rock, 21.iv.1970, J.R. Brownlie (MEL 37806); The Olgas, 4.vii.1968, A.C. Beaglehole 25805 (MEL 1046324); Mt Bruce, northernmost peak of Mt Olga domes, 10.ix.1965, J.H. Willis (MEL 11237).

*South Australia* - Big rock, 5 miles E. of Teeta Bore, Everard Ranges, 24.xi.1975, Rex Filson 15659 & Sue Filson (MEL 1018612).

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